DOCUMENT RESUME

ED 382 174 IR 017 110

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TITLE	The Virtual Classroom and Vertically Integrated Technology Training for Education: New Paradigms for Telecommunications Technology Training of School Personnel.
INSTITUTION	PREPS, Inc., Mississippi State, MS.
PUB DATE	94
NOTE	33p.; Paper presented at the Annual Conference of the Mid-South Educational Research Association (Nashville, TN, November 10, 1994).
PUB TYPE	Information Analyses (070) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Computer Attitudes; *Computer Networks; Cooperation; Discussion Groups; Electronic Mail; Information Networks; *Inservice Teacher Education; Integrated Curriculum; Pilot Projects; *Teacher Student Relationship; *Telecommunications; *Training Methods
IDENTIFIERS	Internet; *Vertically Integrated Technology; *Virtual Classrooms

ABSTRACT

Two new training and development initiative practices addressing telecommunications (Internet) training for education are presented: the Virtual Classroom and Vertically Integrated Technology Training (VERITTE). These techniques may be applied separately or in combination to develop competencies and positive attitudes among school personnel toward use of telecommunications in education. The Virtual Classroom seeks to apply telecommunications to enhance interconnectedness of classrooms, students, and teachers to each other and the outside world, thereby enhancing the learning resources of schools. It involves an elaboration of the electronic discussion group commonly implemented between individuals and groups on the Internet, and ideas are shared through the use of electronic mail and other electronic communication techniques. By engaging in active and cooperative learning experiences during training, teachers learn of the extensive information sources available to them and their students via telecommunications. VERITTE is a model for educational training and development which draws on Senge's concept of "the learning organization," an organization which is inherently systemic and non-hierarchal. Students, administrators, and teacher all: perform knowledge work toward the accomplishment of the organizations' goals; need to be competent in the use of the productive tools of organization (computers, etc.) to perform their work; bring personal resources of skills and knowledge to the accomplishment of work; and are relied upon to bring a sense of their personal responsibility to their work performance. Through VERITTE, training and development activities simultaneously address all levels of the school organization in shared learning experiences. The paper also describes results of a pilot test of the Virtual Classroom and VERITTE in public schools. An appendix provides a transcript of an electronic discussion on the training and development practices introduced in this paper. (Contains seven references.) (MAS)

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THE VIRTUAL CLASSROOM AND VERTICALLY INTEGRATED TECHNOLOGY TRAINING FOR EDUCATION: NEW PARADIGMS FOR TELECOMMUNICATIONS TECHNOLOGY TRAINING OF SCHOOL PERSONNEL.

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A Paper Presented At The Mid-South Educational Research Association Annual Conference, Nashville, Tennessee; Thursday, November 10, 1994.

IR017110

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Abstract

Two new training and development initiative practices addressing telecommunications (Internet) training for education are presented. Effective technology training of school personnel is essential for successful classroom adoption of wide-area telecommunications resources such as the Internet and the planned National Information Superhighway. Adoption of technological innovations occurs only when the uses and characteristics of the proposed innovations are understood by practitioners to be compatible with their needs, goals, and responsibilities (see Cuban, 1986; Hodas, 1993). Acceptance in the classroom of wide-area telecommunication systems will occur when the participants in the educational process perceive these technologies as:

- readily accessible to teachers and students,
- simple, reliable, and flexible tools,
- genuinely meeting the needs and goals of teachers and students, and
- compatible with the intrinsic cultural values of the school organization.

Two paradigm changing initiatives to address technology training have been informally applied by practitioners, but have not been systematically implemented and evaluated for telecommunications training. This presentation will describe these two new training and development initiatives: the Virtual Classroom and Vertically Integrated Technology Training for Education (VERITTE). These techniques may be applied separately or in combination to develop competencies and positive attitudes among school personnel toward the use of telecommunications in education.

The **Virtual Classroom** is an electronic classroom which can be expandable in time, space, and content. Its informational territory can grow indefinitely as new knowledge and resources are acquired and as the capabilities of new members are added. **Vertically Integrated Technology Training for Education (VERITTE)** contrasts with the conventional paradigm of educational technology training wherein administrators and teachers are trained in one venue and students in another. With VERITTE, persons at multiple levels of schools are trained simultaneously.

Introduction

Despite the availability of basic telecommunications access on the part of an increasing number of school districts, practical and effective application of these technologies is presently limited by several factors. These include:

* Full extension of telecommunication access to all schools and students,
* Adequate technical knowledge and skill development among staff, faculty, and students in school districts to support the effective use of telecommunications systems, and
* Adequate methodological knowledge of how to integrate telecommunication technologies and services into learning activities.

This paper will address issues pertinent to the last two of these factors directly. The emphasis will be on developing knowledge, understanding, and skills, particularly at the classroom level, to support and sustain the use of telecommunication technologies and related informational resources for the enhancement of education.

Telecommunication offers the following positive benefits to education.

1. Telecommunication competencies are basic to the implementation of Virtual Classrooms in the context of a Virtual Communication Community of schools.

2. Telecommunication and telecomputing involve entire systems of technology including computers. communication links and devices, peripheral input and output devices, remote computer systems and resources, and a variety of software applications. Through knowledge of these diverse resources and applications, the learner becomes able to select and control ways in which she or he wants to interact with the system. This encourages an active and creative attitude toward the use of technology to perform academic learning and problem solving.

3. Telecommunication and telecomputing competency enables and encourages learners to acquire a broader and more practical understanding of computer usage than any other sort of application relevant to education.

4. Telecommunication represents a portal to ever expanding reserves of research information in textual, graphic, audio, and motion video forms of interest to students, teachers, and administrators.

5. Telecommunication presents opportunities to interact with learners and practitioners at remote locations, enabling sharing of learning and problem solving with others throughout the nation and around the world. Such access is especially enriching to those in small school districts situated in rural areas with limited local resources and great distances between schools.

6. Telecommunication can enhance the collective abilities of teachers and administrators for solving shared problems,

7. Telecommunication is a technology which can be strongly self-reinforcing in its appeal as users become proficient in its uses. It is perhaps the most human and humane of relevant technologies in that it represents a way of communicating with other people and hence enjoys a popularity with those who use it regularly that is not usually associated with other computer applications in education.

8. Telecommunication is an application of technology which is becoming increasingly relevant to the lives of American citizens. The place of electronic communication in the future promises to be central and ubiquitous. The acquisition of ability in its use equips learners with extremely useful skills directly relevant to further education and the world of employment.

9. Telecommunication skills and knowledge potentially have a long life of usefulness without prospect of obsolescence for the learner. Future developments and increasing sophistication of on-line tools and resources (e.g., Mosaic and other graphical and hypertext/hypermedia oriented services) will enhance the value of such knowledge rather than make it obsolete.

In order to expedite making telecommunication technologies dynamically and innovatively useful to both teachers and students as a regular part of the classroom learning experience, two ideas for personnel development are proposed: The Virtual Classroom and Vertically Integrated Technology Training for Education (VERITTE). These ideas are formulated in consideration of the history of slow and incomplete adoption of previous technological innovations in education.

Technological resistance, reluctance, and refusal in the classroom

The history of efforts to reform educational practices and methods through the use of technological innovations is replete with examples of the general failure to achieve more than partial, tentative, and temporary application of such technologies (see Cuban, 1986; Hodas, 1993). Cuban (1986) has reviewed consistent patterns of limited acceptance and application of such technologies as radio, movie film, filmstrips, television, and computers in education. Cuban's analyses of the dynamics of technology reluctance and refusal at the classroom level have indicated that the causes are complex, but are partly related to the tendency of practitioners to conserve existing practices as being in the best interest of their students and of maintaining effective classroom practice as it has evolved over time.

Willing adoption of a technological innovation occurs only when the uses, characteristics, and inherent values of the proposed innovation are understood by the practitioners to be compatible with their needs, goals, and values. In the case of new technologies in education, this means that the practitioner must come to view the new technology as congruent with her or his perceived professional responsibilities. Cuban (1986), applying his explanation of "situationally constrained choice" for limited classroom applications of technology, says

> "...because of severe constraints imposed upon teachers by the classroom and school as workplaces and the imperatives of their occupational culture, teachers will seek out those tools that meet *their* tests of efficiency: Is it simple? Versatile? Reliable? Durable? What is the personal cost in energy versus return in worth for students? Will these machines solve problems *teachers* (and not nonteachers) define?" (p. 66)

Substantive and meaningful acceptance and application in the classroom of such new tools as microcomputers, local area networks, and long distance telecommunication systems will occur only when the classroom participants in the educational process perceive these technologies as:

- readily accessible to both teachers and students,
- simple, reliable, and flexible tools, and
- genuinely meeting the needs and goals of teachers and students.

In addition, Hodas (1993) notes that conflict and resistance occur when the values inherent in a technology do not support the values imbedded in existing school establishments, including those related to the established flow of power, information,

and authority. Schools, as organizations, behave much as organisms which seek to preserve their existence and ways of existence. They react with defensive resistance against proposed innovations which convey implications of criticism for existing practices and which threaten established structures of power, position, and prerogative. Essentially, as Hodas observes, the inherent values of new technologies can often be perceived as incompatible with those of existing organizational cultures, and those cultures will seek stability by resisting changes in values implicitly required by the technological innovation. Hodas (1993) identifies the following characteristic traditional values of established education in this connection:

- respect for hierarchy
- competitive individualization
- a receptivity to being ranked and judged
- the division of the world of knowledge into discrete units and categories susceptible to mastery.

Consideration of telecommunication in education will show that it contains and conveys inherent values which are antithetical to those listed above. First, the nature of telecommunications is anti-hierarchical. Since, in principal, anyone can communicate with anyone at will, traditional organizational structures and barriers become irrelevant. Further, collaborative learning via telecommunication networking is incongruent with education's usual competitive values for performance and assessment. Finally, the access to vast amounts of information organized in terms of meaningful, cross-disciplinary associations via hyperlinking is inconsistent with the traditional strict disciplinary and hierarchical subdivisions of knowledge.

Any serious effort to implement technological innovations such as telecommunication must take account of organizational cultural factors which are beyond the strictly rational bounds of objectified problem solving, no matter how potentially beneficial the new practice or resource. Genuine systemic change in education via technological innovation awaits the development of effective means to address the root causes of technology refusal and reluctance at the classroom and school level. These means must, as a necessary condition, address difficult issues related to the development among personnel of both basic technical competencies and the willingness and ability to use the new technologies meaningfully. The concepts of the Virtual Classroom and Vertically Integrated Technology Training for Education (VERITTE), and their application in combination, were developed with these challenging issues in mind. In the next sections, the Virtual Classroom and VERITTE will be discussed in greater detail.

The Virtual Classroom

The Virtual Classroom generally seeks to apply telecommunication to enhance interconnectedness of classrooms, students, and teachers to each other and to the outside world and thereby enhance the learning resources of schools. The concept of The Virtual Classroom is an elaboration of the electronic discussion group which is commonly implemented between individuals and groups on the Internet. Via telecommunication, the members of a discussion group form a network for communicating regularly due to shared interests or responsibilities. Through the use of E-mail and other electronic communication techniques, the members can share ideas and information with all members of the group simultaneously. This method is an effective, convenient, and rapid way to interchange information and other responses with a group of people of like interest.

The idea of the discussion group is readily developed into the concept of an extended group of students and educators linked together for mutual support and sharing of learning. Moreover, the Virtual Classroom provides the potential for connection with other knowledgeable individuals who would not ordinarily be involved in classroom processes. For instance, a course in chemistry could include in its "membership" professional chemists and chemical engineers who have Internet access, college level chemistry students, and others who may provide valuable input into the learning process. Furthermore, those involved in the Virtual Classroom may routinely access the extensive databanks of knowledge and information available through the various resources and services which participate in the Internet system. The concept is quite flexible and could be manifested in any number of specific configurations to serve the learning interests of different courses, groups, and occasions.

The Virtual Classroom is a classroom without walls. It is an electronically networked educational venue with human and technical resources for conveying knowledge, skills, and understanding to learners via telecommunication on a local, regional, or more wide-area scale. It is, in principle, unbounded by geography, organizational area, or any physical limits. It is extensible in space, continuous in time, and flexible in organization.

The Virtual Classroom will serve the purpose of all classrooms - to provide an environment and resources for the acquisition and conveyance of new knowledge. However, in several respects, the Virtual Classroom differs significantly in concept and operation from the conventional one.

- The Virtuai Classroom is expandable in time, space, and content.

- The informational territory of the classroom can grow indefinitely as new knowledge and resources are acquired and as the capabilities of new members are added.

- The Virtual Classroom has continuity through time. It is not limited to conventional academic time segments (semesters, school years, etc.). As successive groups of learners are added, previous learners need not leave but can remain to continue their learning and to support the learning of the "new students".

- Any member of a Virtual Classroom can be in contact with any member of any other connected classroom, whether virtual or physical, so that information and problem solving capabilities can be mutually shared and reinforced through collaborative interconnection.

The Virtual Classroom model is applicable to any academic learning. The interest here is in its use in the training and development of school personnel to use telecommunications with competency, willingness, and educational effectiveness. The development of school personnel in telecommunication training using telecommunication systems in the process will create an active, participative learning experience. Networks of learners engaged in related learning can provide each other with support and encouragement throughout the learning process. This circular, self-reinforcing learning process has the effect of using the tool to improve the use of the tool, and thereby to improve the tool user. The interaction of teachers with other teachers, via electronic networking, will create a situation in which the sharing of problem solving information and ideas among professional peers dealing with the same learning experience can occur naturally during the training process.

Beyond acquiring essential technical competencies for telecommunication (E-mail, file transfer, remote access to information and computer resources, etc.), teachers have to develop knowledge and abilities to make effective use of telecommunication resources and service in their classroom instruction. By engaging in active and cooperative learning experiences during training, teachers can learn of the availability of extensive information sources available to them and their students via telecommunication. The teachers so engaged can easily serve as resources to each other, forming a virtual community of professionals with like challenges and interests. This is a process which can lead to a change of organizational values and culture from one which avoids the application of technologies in the classroom to one which applies telecommunication, and related computer-based technologies, as a matter of course. Further, through first-hand experience of telecommunication, teachers can

experientially learn how readily the usual limitations of the classroom are cast off by the presence of a link to the outside world that can be used creatively and at will by students.

Experiential learning and cooperative learning are the key ingredients in the use of Virtual Classrooms to teach telecommunication abilities. However, the maximal benefits of networking for telecommunication training will be realized when such learning experiences integrate the various levels of schools and/or districts in simultaneous, coordinated, shared, and mutually supportive learning situations which effect conditions for a genuine learning organization. The VERITTE concept, described below, provides a model for such systemically unified learning.

VERITTE

VERITTE, Vertically Integrated Technology Training for Education, is a model for educational training and development which represents a new paradigm in this area. The model draws part of its inspiration from the concept of "the learning organization" (Senge, 1990). The learning organization is inherently systemic and non-hierarchical. Hodas (1993), in describing the characteristic hierarchy of education, observes that:

> "At the bottom, in terms of pay, prestige, and formal autonomy are teachers. Next up are building-level administrators, and finally, district-level administrators. Although students have even less power than teachers, and state-level actors more power that district administrators, neither of these groups is considered a part of school organizational culture."

This structure embodies and sustains the conventional flow of power, information, and authority in education. It represents a hierarchical and organizationally exclusivist value system which is in some ways incompatible with values inherent in telecommunication as a technology. In contrast, a fundamental tenet of VERITTE is that the place of students as "personnel" in an educational organization is fully as legitimate as that of salaried staff in the following significant ways. Students, administrators, and teachers all:

- perform knowledge work in the school setting toward the accomplishment of the organization's goals,
- need to be competent in the use of the productive tools of the organization (computers, etc.) to perform their work,
- bring personal resources of skills and knowledge to the accomplishment of the organization's work,

- Are relied upon to bring a sense of personal responsibility to the performance of their work.

Although the various strata of schools have their identifiable roles, there is a unifying value in developing the skills and abilities of all persons in a school system to use the organization's technological resources for performing their respective tasks and satisfying their respective needs and goals. This value is not well served by the conventional paradigm of educational technology training wherein administrators and teachers are trained in one venue and students in another. In conventional educational technology training, teachers are taught an innovative practice in an isolated learning situation (e.g., inservice training, preservice education, etc.) and are then expected to transfer that learning to their students in the classroom. All too often, this expected transfer of knowledge does not take place. Vertically Integrated Technology Training for Education seeks to address entire school buildings or systems as learning organizations. The developmental task is conceived as integrated across conventional organizational boundaries. What is needed is not a fragmented and sequential developmental process, but an integrated, global, and simultaneous development of the organization and its members to fully and expeditiously realize the potentialities of the innovation. Through VERITTE, training and development activities simultaneously address all levels of the school organization in shared learning experiences.

Including students in the category of school personnel, as Cuban points out, is not in keeping with customary interpretations of school organization. Because of the dichotomization of the "personnel" of educational organizations separating students from non-students, an approach to personnel development for technology application is customarily used which historically has not worked very well. Teachers and other staff are trained to use new technologies or other innovations in one venue and students are trained and developed in another. Long before students have the opportunity to learn about or use new technologies and applications in the school, staff and faculty must first be completely trained and prepared. Thereafter, those staff so trained and developed are presumed to be ready to (that is able and willing to) bring this new knowledge into the classroom.

The faulty assumptions of this approach have been demonstrated in practice again and again through a long list of innovations, technological and otherwise, throughout this century. Transfer of such knowledge and genuine adoption of innovation in education has proven to be slow at best, and frequently an infertile process altogether. This is largely due to the modes of personnel development traditionally applied.

Vertically integrated training applied to telecommunication competence will result in widespread, simultaneous increase in knowledge at multiple levels of the participating schools. This will create opportunities for mutual support of learning and will mean that, following a training experience, there will be a large number of knowledgeable individuals in the school and classroom, rather than a relative few. Such training activities can simultaneously train students, teachers, and administrators in the use of telecommunication and telecomputing. These learners can then offer each other mutual support in their learning endeavors and can teach others what they know. This is a step toward the creation of an organization-wide learning culture at the classroom, school building, and district levels focused upon the applications of computer and telecommunication technologies.

Familiar observations of the learning by young people of technologies of interest to them further indicate how and why it may be useful to consider a radical departure from traditional development practices via the VERITTE model. In a formally unstructured situation, when children have access to technology they find interesting, casual observation indicates that they will learn as much about it as they want to without coaching or teaching. Considerably less casual observation on the part of Seymour Papert is consistent with this common observation. Papert says, "If children really want to learn something, and they have the opportunity to learn it in use, they do so even if the teaching is poor. For example, many learn difficult video games with no professional teaching at all!" (Papert, 1993, p. 140). Papert describes a variety of different occurrences in which students have used computers in surprising and creative ways to learn when allowed to find their own way in the use of the devices.

This phenomenon is illuminated by the undeniable fact of the multimillion dollar industry related to the creation, production, marketing, and sales of video game technologies. These devices are, after all, merely microcomputers optimized for entertainment uses. The computer game industry is substantively founded upon the proven capacity of young people to engage in self-teaching in the use of the devices. This phenomenon has to call into question the hierarchical, fragmented, and restrictive approach to the application of computer technology conventionally applied in school.

This capacity and inclination of students to learn to use technology as they want to, driven by internal motivations and without formal guidance, represents a potential for organizational learning which is not exploited under the conventional hierarchical design of education. In the typical school situation, the most basic assumption is that knowledge flows from the authoritative source, the teacher, downhill to the less knowledgeable students. However, it is a commonplace observation that adults are frequently less facile learners of uses of new technologies than young people. Whatever the dynamics and causes behind this phenomenon, the implication is that

students who have to wait for teachers to learn new technologies before they themselves can learn them, are unnecessarily delayed in their learning. In addition, young people can learn from each other about the uses of technologies at least as well they can from adult teachers. However, these notions are clearly inconsistent with the established values of hierarchy, authority, top-downward information flow, and control which characterize current educational systems.

Vertically integrated training will develop age-appropriate technical capacities in students and teachers simultaneously. It is to be expected that the readily trained minds of the young will, in not a few instances, accept and acquire competence with technologies faster than their teachers do. By one interpretation, this situation should lead to resistance by teachers, insofar at it is contrary to the established hierarchy of authority in the classroom. The very real probability is that many young students will acquire technical proficiency in telecommunications more quickly than their teachers at the outset. This presents an, at least temporary, threat of loss of authority to teachers during the process of development which must accompany any new technology use in the classroom. Hodas (1993) considers this point, saying,

> "...an unfortunate (but hardly unforeseeable) consequence of school organization is that teachers for whom authority is important must prevent their students from acquiring or demonstrating mastery of a degree or a domain that would reflect unfavorably on the teacher. ...It is one thing for students to demonstrate expertise in areas that are not expected to be a formal part of teachers' skill set, like threading 16mm projectors. If technologists have their way, however, teachers will be expected to know how to use computers, networks, and databases with the same facility they now use blackboards and textbooks, and with greater facility than the roomful of resourceful, inquisitive students who were weaned on the stuff."

Therefore, the prospect of simultaneous, vertically integrated training in a new technology may present a threat of loss of authority and control to teachers. This expectation, however, is directly related to the traditional organization of power and information flow in schools. It can be see that a conflict of values between the established order in education and the inherent values in the VERITTE model exists.

On the other hand, the development of a learning community within the classroom, in which the support of technology learning becomes "all-way" rather than top down, can directly address a solution to a pressing, practical teachers' problem. The burden of being the sole bearer of responsibility for developing student technical competence and, ultimately, for developing appropriate applications, is lifted and

distributed over a number of contributive agents - the entire membership of the class, or of the Virtual Classroom. The full application of telecommunication to education will not be embodied a specified curriculum, but in creative applications across the board. Usages will be discovered and invented, rather than prescribed, just as uses of telecommunications in other arenas of endeavor including business, higher education, and individual avocations have this personal resourceful and inventive quality. Basic activities accessible to learners include communication via e-mail, the search of remote databanks of information, transfer of information files, search for information via hypertext and hypermedia links, remote computer access and operation, communication with content area experts and professionals outside the school system, and group and individual cooperative learning activities with partners at remote locations. These basic ingredients, and more yet to come, will be woven into innumerable different tapestries by the participants as they integrate them into all aspects of the learning process. It is absurd to suppose that individual teachers, acting authoritatively, could begin to plumb the depths of telecommunications resources. The task of developing and exploiting telecommunications for education will need all available minds to maximize the advantages of it.

Combining the Two Models: issues of Program Evaluation and Learner Assessment:

The complete expression of the technology training model envisioned in this paper is in the **operational combination** of the Virtual Classroom and VERITTE models for telecommunication training and development. Teachers, students, and staff of schools can be simultaneously involved in coordinated and integrated developmental activities through local- and wide-area networks which have continuity and extensibility. This is obviously a model which combines the functions of student education, staff development, and organizational development in a systemically unified process. Its intended individual and organizational learning consequences can be expected to expand the regular educational missions of schools in ways which are inherently suited to the characteristics of telecommunication technologies and consistent with often heard wishes and admonitions to reinvent the learning methods and characteristics of contemporary educational institutions.

The combined model provides experiential, contextual, performance-oriented, and discovery-oriented learning experiences combined with cooperative, "all-way" mutually supportive learning. In such a learning environment, values are in play which tend to be contrary to the traditional values of educational establishments as identified by Hodas (1993). The traditional values of hierarchy, separateness of teachers and students, primary emphasis on verbal learning, strict compartmentalization of knowledge into subject areas, and individual competition of students for comparative ranking are inconsistent with the inherent characteristics and values of the proposed

methods. The Virtual Classroom-VERITTE combination integrates two levels of technology learning: 1. basic technical competencies in using telecommunication tools and resources and, 2. meaningful application and utilization of those tools and resources to solve problems and achieve educational purposes. The overall goal is to develop effective habits of use at both individual and organizational levels. Such learning then becomes both ends and means for assessment and evaluation. The goals and objectives of such learning must necessarily and intentionally be "ill-defined". Goals and objectives cannot be precisely explicable or definable because of the various contextual circumstances of the learning processes. Such learning processes will vary considerably among various implementations. More than a matter of teaching this teacher or that student, the purpose is to educate an organization of learners to operate in some new ways using new resources. In such a learning situation, assessment and evaluation issues themselves represent new territory for inquiry and discovery.

In direct relationship to the points above, it is evident that the traditional values and methods which underlie conventional, objectives-oriented learning program evaluation and student learning assessment are also called into question in the proposed Virtual Classroom - VERITTE combination. Questions concerning how to address these evaluative processes define a research agenda necessarily to be associated with the model described here and with the application of wide-area telecommunication in education in general. If full-fledged cooperative, mutually supportive, experiential, performance-based, discovery-oriented learning is to be supported by the new telecommunication technology, then questions concerning evaluation and assessment emerge as paramount. However, these issues are not fundamentally different in kind from those which have been and are being broadly considered about such learning without the support of telecommunication (e.g., Wiggins, 1993; Gardner, 1977). What is different here is that the use of telecommunication technology provides both ends to be evaluated and means to pursue evaluation. The combination model proposed can enable the unification of learning processes and assessment processes.

At a minimum, it appears intuitively evident that meaningful evaluation and assessment in this context must be guided not merely by objectives-oriented questions about how people and programs are doing, but by inquiries concerning how their learning and applications are being done , and with whom they are doing them.

Virtual Classrooms and VERITTE: Examples and Proposals in the Real World

The Virtual Classroom in Action

The ideas explored here are new and will only find their most effective shape through the cut and try of actual experience. Even so, examples can be found of initiatives which reflect the philosophy of the Virtual Classroom. At Mississippi State University, the authors have been involved in courses and seminars in which Virtual Classrooms connect networks of learners and teachers both local and distant. For instance, members of a seminar in Planning for Technology were joined together in a discussion group which extended nationwide and included over two hundred members. The non-local members were mostly professional educators who had an interest in the subject matter. Some of the non-local members had participated in the seminar as local class members in previous semesters, and chose to maintain their membership in the Virtual Classroom via the Internet. In all respects this scenario met the criteria for a Virtual Classroom as envisioned here.

The value of this extended network of learners and teachers as a forum for sharing and examining new ideas was demonstrated when, as the concepts which underlie VERITTE were emerging, a message asking the members for their opinion of it was distributed through the Internet. Several members of the Virtual Classroom forwarded the posting to other discussion groups of which they were also members. Eventually the posting traveled to thousands of recipients and provoked a number of illuminating and helpful responses. A further demonstration of the capacity of this Virtual Classroom for extending ideas and information to distant audiences was represented by a request, which came via the Internet, to publish the original posting in Clipboard, the newsletter of The Minnesota Society for Technology in Education.

Some of the most interesting and valuable responses to the posting received via the Internet were from practicing educators who reported already having had some experience with teacher-staff-student training and development activities which had the basic qualities of vertically integrated training. A selection of relevant responses is contained in the Appendix of this paper.

Pilot Testing the Virtual Classroom and VERITTE in Public Schools

PREPS, Inc. of Mississippi State University is currently working with several school districts to pilot test, refine, and apply the concepts and practices of the Virtual Classroom and VERITTE. These plans include developing a Virtual Classroom to support staff development for telecommunications throughout several rural school districts in Mississippi. Further, according to one plan, three rural elementary schools

are to participate in a process of vertically integrated training for telecommunication which will address coordinated training to students, teachers, and administrators. These limited pilot tests of ideas and procedures will provide the groundwork of experience and knowledge on which to develop a VERITTE training network via the Virtual Classroom model which can be utilized in any rural school setting, given the development of the requisite technical infrastructure for Internet access by students and school staff.

Investigating the Learning Assessment Issues

At Mississippi State University, an established graduate level course in the use of telecommunications via the Internet, taught by the Department of Technology and Education, will be used in the Spring of 1995 as a basis for examination of issues pertaining to assessment of student learning in a Virtual Classroom environment. The students of the course are primarily Education majors. Many are classroom teachers and school administrators pursuing advanced degrees. The course is designed to provide knowledge of the Internet and the wide-area network environment and to develop operational competency in use of the tools and resources within this environment. The inquiry into assessment issues will address the modes of learning and operation of students as well as their achievement of course objectives. Of specific interest in the study will be the possibility of applying ongoing assessment information to adjustments to the instructional/learning process as the course proceeds, on an individual student and whole class basis.

Summary Observations

The implementation of the Virtual Classroom and vertically integrated training for telecommunications technology can only be fully realized in circumstances in which the infrastructure for local- and wide-area electronic networking is highly developed. This situation is not currently characteristic of public education. However, school systems are increasingly equipping themselves with the necessary technologies. A serious caution needs to be emphasized here. The mere accumulation of technological resources for schools without thoughtful processes of technology planning will have limited positive impact on educational practices, institutions, or students. Inadequately planned technological development often leads districts and schools to, with the best of intentions, invest heavily in computers and related devices and systems, only to find the educational return on their investment is less than expected and that the systems purchased are too soon obsolete. Fortunately, the approach education is taking more and more toward technology development, with heavy emphasis on careful and meaningful planning, bodes well for the prospect of effective, cost-efficient, and enduringly useful technological systems in school settings. The National Center for Technology Planning (NCTP) at Mississippi State University supports such effective

planning and development via an electronic network of mutually supportive practitioners in school systems nationwide, implemented via the Internet (lsa1@ra.msstate.edu). The NCTP is itself an example of a professional and organizational development-oriented electronic learning network, similar in function to a highly informal version of a Virtual Classroom.

In order for public education to realize its potential for our culture in the knowledge-intensive future, it will have to make use of the informational resources represented by the Internet and the planned National Information Infrastructure. Therefore, the assumption that the technical requirements will eventually be met at the school level seems to be tenable, even though the state of the art currently is considerably less than that typically found in business, government, or other major social institutions.

Given the technological resources, dealing with the challenges to their effective utilization in education will focus on human-professional and organizational-cultural issues. It seems highly probable that the educational milieu will be altered significantly in the future, not merely by the presence of new technologies in the educational environment but also by the associated social and cultural changes which will manifest themselves in the larger world. The topics dealt with here may give useful clues to the shape of some of the cultural, attitudinal, and procedural changes that may characterize the organization and practices of formal learning institutions in the future. The Virtual Classroom model and the educational processes of vertically integrated technology training have the potential to directly facilitate, actualize, and symbolize the future shape of education. In a fully realized technological environment, the combination of the Virtual Classroom model and VERITTE methods for effecting and sustaining technological effectiveness in education can become a part of ordinary procedures.

Currently, education is engaged in a transitional period with respect to new technologies which is unique in its history. No previous technologies which have been proposed to "revolutionize" education have simultaneously had identical or equivalent revolutionary consequences for the larger world. These consequences are due to the impact of these new tools and systems on the way people, groups, cultures, and nations are dealing with information, knowledge, and professional and personal relationships. Previous socially and economically significant informational technologies, such as motion pictures, radio, and television, have had limited substantive effects on education. A crucial distinction is that telecommunication and telecomputing greatly extend **personal** informational power combined with the potential for human interaction on an intimately individualized level to those who are able to use them effectively. Therefore, this new medium significantly alters the traditional flow and control of information. This combination of ingredients is without an exact precedent in history,

including the widespread implementation of the printing press. It will be surprising, indeed, if its consequences for education are not profound.

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Appendix

From inzina@ouvaxa.cats.ohiou.edu Mon Mar 14 13:38:52 1994
Date: Fri, 11 Mar 1994 10:08:16 EST
From: inzina@ouvaxa.cats.ohiou.edu
To: MTW5@RA.MSSTATE.EDU
Subject: Introduction of Technology

Ohio University Electronic Communication

Date: 11-Mar-1994 10:07am EST

To: Remote Addressee (_mx%"mtw5@ra.msstate.edu")

From: Barbara Inzina Dept: CaTS
INZINA Tel No: 614.593.1035

Subject: Introduction of Technology

Ted,

I found your "essay" on training for use of instructional technology very thought provoking. We are in the process of introducing a K-12 Internet service called "Academy One" into an impoversihed elementary school that has virtually no computer experience (teachers or students). We have three "interested" teachers who now have e-mail accounts and are poking at the system. Though we've studied technology diffusion theory and research, the thought of your approach did not occur to us. We were not allowing our thoughts to be bold enough to even have a chance of considering what you suggest.

We have forwarded your note to our three initial teachers/explorers. We may be able to try out your theory by including some students with the teachers in a group. The first thing that has to happen is that the teachers have to buy into letting that happen. Their egos are all pretty strong so it might work.

My parting (guilty) thought is that I wonder why when we think about introducing change to the classroom teacher/learner environment, why do I not let my thoughts be bold?

Thanks,
Barbara Inzina Director, Technology Services
Ohio University binzina@ohiou.edu

From LROBBINS@macc.wisc.edu Mon Mar 14 13:40:15 1994
Date: Sat, 12 Mar 94 20:38 CDT
From: "Louise S. Robbins SLIS 263-2105" <LROBBINS@macc.wisc.edu>
To: MTW5@RA.MSSTATE.EDU
Subject: personnel development, or your proud prof

Ted, your ideas about folks learning concurrently, or schools being learning organizations (perish the thought! 8-)) struck a chord with me. I'm an assistant prof in the School of Library and Information Studies at the Univ of Wisconsin-Madison, and I run a teaching library! One of the things I have tried hard to do is to model the learning organization. Frequently I organize workshops in which students are the teachers of the faculty, or if a problem with technology arises, we all (whoever is available to struggle with it) gather around and work together to solve the problem. Students are constantly my teachers, and I hope I am reciprocating. It's an extremely energizing and I believe effective teaching/learning mode. I haven't done any studies, mind you, but maybe they are in the future. Good luck. Pursue your idea.

Sincerely,

Louise Robbins

Louise S. Robbins Assistant Professor and Director,
Laboratory Library School of Library and Information Studies University of Wisconsin-Madison 600 N. Park Street Madison, WI 53706 Phone: 608-263-2105 (office) or 263-2963 (laboratory library) lrobbins@macc.wisc.edu or lrobbins@wiscmacc.bitnet

From lsa1@Ra.MsState.Edu Mon Mar 14 13:40:51 1994
Date: Sat, 12 Mar 1994 22:31:23 -0600 (CST)
From: "Dr. Larry S. Anderson -- NCTP" <lsa1@Ra.MsState.Edu>
To: mtw5@Ra.MsState.Edu
Subject: Re: An Idea (fwd)

Ted, here's some good info for you.

Larry S. Anderson, Ed.D. LSA1@Ra.MsState.Edu
Asst. Prof., Dept. of Technology & Education Voice: (601) 325-2281
Founder, National Center for Technology Planning Fax: (601) 325-7599
Director, Instructional Technology Mississippi State University

---------- Forwarded message ----------
Date: Sat, 12 Mar 1994 14:25:13 -0800 (PST)
From: Larry Hiner <lhiner@eis.calstate.edu>
To: "Dr. Larry S. Anderson -- NCTP" <lsa1@Ra.MsState.Edu>
Subject: Re: An Idea (fwd)

Larry A.:

I don't mean to pop your proud bubble, but I've been doing exactly what Ted proposes for nearly four years with students (and teachers) in California - teaching them to use LinkWay to create their own projects with assistance and guidance from the teachers. In fact, that process has been formalized and available nationally as a service offering from IBM/EduQuest for almost a year now, known as "Multimedia Student Projects." You might refer your student to the writings of Fred D'Ignazio (self-proclaimed 'Driving Instructor' for 'Explorers on the Electronic Highway;' of the company 'classroom without walls' (sic) in Michigan, 517-349-1340). He's often espoused the training of students as the key to gaining acceptance of the new technologies (multimedia, the Infobahn, etc.) and to improve the likelihood of their integration into the curriculum. You can tell Ted that his idea is far from crazy; in fact, it's desireable, practical, well-received, it promotes active interest in the technology (and what it can do) with teachers, students, administrators, and parents. It's even profitable (insofar as IBM is concerned).

****

Larry Hiner
EduQuest, An IBM Company
Sacramento, California
****

From ldonlan@eis.calstate.edu Mon Mar 14 13:41:10 1994
Date: Sat, 12 Mar 1994 20:36:29 -0800 (PST)
From: Leni Donlan <ldonlan@eis.calstate.edu>
To: Marion Theodore Wesley <mtw5@Ra.MsState.Edu>
Cc: tkt8763-01@Ra.MsState.Edu
Subject: Re: An Idea

Ted,

I am a practicing teacher and a graduate student, also. I have been considering how to implement such a plan for some time now! It makes a great deal of sense to me for a number of reasons. I think teams of students and teachers have a "balance" of brashness and derring do, as well as wisdom and restraining caution. This kind of "learning together" process is a wonderful bonding experience for future success in the school setting in all contexts. Students need to know that their teachers are also learners, and teachers need to see students as successful learners in a context that may be uncomfortable for the adult learners. Sharing the responsibility for learning and disseminating the knowledge gives the students a real role and responsibility in their own learning. Teachers need all the help they can get. Students are a great deal of help and very willing to be helpful when they know they have a real role to play. I could go on and on....your note triggered my desire to implement some kind of a student/teacher training opportunity..... If time and my creativity bring this to fruition, I will share the results with you!

Leni Donlan
<ldonlan@ctp.org>

From lsa1@Ra.MsState.Edu Mon Mar 14 13:42:27 1994
Date: Mon, 14 Mar 1994 07:25:22 -0600 (CST)
From: "Dr. Larry S. Anderson -- NCTP" <lsa1@Ra.MsState.Edu>
To: mtw5@Ra.MsState.Edu
Subject: Re: An Idea (fwd)

Ted, your message is causing a *lot* of people to think. Here's one from the EdTech discussion list...

Larry S. Anderson, Ed.D. LSA1@Ra.MsState.Edu
Asst. Prof., Dept. of Technology & Education Voice: (601) 325-2281
Founder, National Center for Technology Planning Fax: (601) 325-7599
Director, Instructional Technology Mississippi State University

---------- Forwarded message ----------
Date: Sun, 13 Mar 1994 20:43:36 EST
From: Joel Henderson <ST801256%BROWNVM.BITNET@uga.cc.uga.edu>
To: Multiple recipients of list EDTECH <EDTECH%MSU.BITNET@uga.cc.uga.edu>
Subject: Re: An Idea

Ted wrote:
> There is the possibility that, upon return to the
> classroom and regular business, everyone in the classroom will
> simultaneously know a lot about what can be done with the new
> methods and tools (and will also know others who know whom they can
> ask if they get stuck) and will be ready to use the new knowledge
> and help others to do so. This would distribute the organizational
> learning and changing process over the entire population of
> involved minds.
>
> This is the essence of the idea, and I know it's whacky. It
> is not born out of much educational training lore, I actually don't
> have a lot of that.

People may want to take a look at _Mindstorms_ by Seymour Papert, which is, in my mind, the best book ever written about the integration of technology and education-- all the more impressive because Mindstorms is more than a decade old. Here are a few excerpts from chapter 1 that are related to Ted's idea: Many writers who work at home are acquiring their own computers, and the computer terminal is steadily displacing the typewriter as the secretary's basic tool. The image of children using the computer as a writing instrument is a particularly good example of my general thesis that what is good for professionals is good for children. ... I believe that the computer as writing instrument

offers children an opportunity to beccme more like adults, indeed like advanced professionals, in their relationship to their intellectual products and to themselves. In doing so, it comes into headon collision with the many aspects of school whose effect, if not whose intention, is to "infantilize" the child. ... In later chapters Papert discusses the fact that in learning LOGO or any other advanced computer system, the chiid and the teacher must learn together-- if only because it's new to both of them. My personal take on it is similar to Ted's and Papert's, though I would further stress that technology today changes so quickly that a school *needs* to have as many people as possible learning and exploring the new tools. Children have quick minds, and often can prove a school's strongest assest in the technological realms: I've worked with one school that realized it didn't know enough to set up its computer systems, so it asked its kids for advice, training materials, and eventually to perform the installation. Not *only* does this empower the students, not *only* does it provide the students with real-world job skills, but it also creates the attitude that Ted describes: one of we're-all-in-this-together, so crucial to learning on the cutting edge.
- Joel

P.S. Just to tie into another thread, guess how many mouse balls will be stolen from this kind of school? :)

Joel_Henderson@Brown.Edu
Demo the EOS ftp/gopher:
--> garnet.geo.brown.edu

EOS: Educational Online Sources
Box 2325 / Providence, RI 02906
eos1@brown.edu / 1-800-ask-eos1

From fwatson@ssi.edc.org Mon Mar 14 13:35:15 1994
Date: Thu, 10 Mar 1994 14:19:40 -500 (EST)
From: Frank Watson <fwatson@ssi.edc.org>
To: Marion Theodore Wesley <mtw5@ra.msstate.edu>
Cc: tkt8763-01@ra.msstate.edu
Subject: Re: An Idea

I have been working on the model you suggest in a small way in Vermont. In three schools this winter I have participated in professional development events that ran doing the regular day so kids, parents, administrators, cooks, bus drivers, etc were part of the mix. Lots of fun and very worthwhile.

From jholland@bvsd.k12.co.us Mon Mar 14 13:42:55 1994
Date: Mon, 14 Mar 94 11:44:43 MST
From: Holland Jerolyn <jholland@bvsd.k12.co.us>
To: mtw5@ra.msstate.edu
Cc: lblack@bvsd.k12.co.us
Subject: Innovative teaching

Ted, I got your message forwarded via Internet on innovative ways to teach. I am a teacher in thé Boulder Valley School System teaching in the CHOICE program. WE do not give grades and we teach 6th, 7th, and 8th grades mixed. OUr philosophy is that we are a family of Learners. On the Internet, we gave students the go ahead to "explore" and come back and teach the rest of us. It was excellent and we are talking all over the world. Another student took the time to set up Packet system of HAM radio via internet and we talked to people in Norway during the Olympics. They were very excited to talk to us and we spent a lot of time talking about events won by US and NOrwegians. When we talked to people from South AFrica, all they could talk about was the Olympics and Dan Janson, Tonya Harding and Nancy Kerrigan. It was great fun and by using students to explore, we found all sorts of ways to use and connect with Internet. I agree that if we wait to train teachers first, we'll be into the 20th century before the rest of the world gets trained. By letting students do the research, they feel they have something to offer that is real and very valuable. Please feel free to share more

---------- Forwarded message ----------
Date: Thu, 17 Mar 1994 09:53:05 EST
From: Bob Mack <bmack%cln@hub.ubc.ca>
To: Multiple recipients of list EDTECH <EDTECH%MSU.BITNET@uga.cc.uga.edu>
Subject: Re: An Idea (fwd)

> Don't train the teachers first (and in
>isolation) and then expect them to train the students in the new
>applications and tools later on in another setting. Rather, train
>and develop everyone who will be using the tools to do their
>respective jobs together and concurrently.

This is how we are doing it in our district. It works, and therefore
allows the things to happen that Ted mentions in the following paragraph.

>There is the possibility of
>encouraging positive relationships between teacher-learners and
>student-learners around the innovation, relationships not founded
>upon the notion that there are those who know and those who don't
>(or those who are able and those who aren't) and the two groups
>don't overlap. There is the possibility that, upon return to the
>classroom and regular business, everyone in the classroom will
>simultaneously know a lot about what can be done with the new
>methods and tools (and will also know others who know whom they can
>ask if they get stuck) and will be ready to use the new knowledge
>and help others to do so. This would distribute the organizational
>learning and changing process over the entire population of
>involved minds.

Bob Mack, bMack@cln.etc.bc.ca
Technology Coordinator
S.D. 88 (Terrace)
Terrace, BC, Canada

From bubar@cc.bellcore.com Mon Mar 14 13:37:24 1994
Date: 10 Mar 1994 21:19 EST
From: bubar@cc.bellcore.com
To: mtw5@ra.msstate.edu
Subject: Innovations in Learning and Teaching

Ted,

Hope the following may be useful.

chuck

---------- begin forwarded message ----------
>From: bubar (bubar,charles o)
To: K12ADMIN@SUVM.SYR.EDU
Cc: bubar
Date: 10 Mar 1994 19:20 EST
Subject: Computers and Staff Development

Deborah,

At the Bellcore Teacher Institute, we found that the critical factor in helping teachers become more technology friendly was building relationships between teachers and scientists/engineers/computer programmers or other technical professionals.

Teacher intimidation by technology is never the result of lack of information. Watching young children play with computers they know nothing about shows this fact very clearly. Rather than lack of information, it is the presence of negative attitudes/expectations/values--regarding (a) technology and (b) my own competence with technology--which are the source of the problem.

When people have these negative attitudes/expectations/values, more information by itself will never solve the problem.

The creation of attitudes/expectations/values happens in ongoing relationships with other people in which the recurring interactions which

happen in those relationships provide the context for the formation of new and more positive alternatives.

Thus the importance of bringing teachers or others who are novices together with technically enthusiastic and personally positive users of technology over a sufficient period of time (at least 6 months) so that the development of positive attitudes/expectations/values can become stable.

In the Bellcore Teacher Institute, we used corporate volunteers. Any type of enthusiastic technology user will do--retired people, college or high school students--provided that the novice is capable of relating to them and they to the novice.

I hope this will be helpful as you consider enhancements to your excellent program.

In terms of personal reflection using the personal computer, it can be very effective for a person to type their questions and concerns on the computer--one at a time--and after each question, take a moment to reflect, and then type out the answer that comes to your mind. Results can range from simply useful to incredibly profound.

Good luck on your program.

Chuck Bubar
Director
Bellcore Teacher Institute
908-699-4117

From 0005739880@mcimail.com Mon Mar 14 13:37:53 1994
Date: Thu, 10 Mar 94 22:33 EST
From: Kathy Juarez <0005739880@mcimail.com>
To: Marion Theodore Wesley <mtw5@ra.msstate.edu>
Subject: RE: An Idea

Well, Ted and others, on a much smaller scale than you have suggested, eight of the ten teachers in our learning community (200 students within a larger 1600 student HS) and 16 students spent a Saturday at our County Office of Education taking a workshop on HyperCard and multemedia together. One of the great benefits, of course, is that the core of trained people is three times as large as it might have been if only teachers had attended. Also, some students are, of course, much more adept at using their new skills and knowledge than some teachers... and if anyone gets stuck, there's almost always someone around (nevermind the age) who can help.

Kathy Juarez
Fulton Valley Prep at Piner HS
Santa Rosa, California